The CRUSHED STONE JOURNAL

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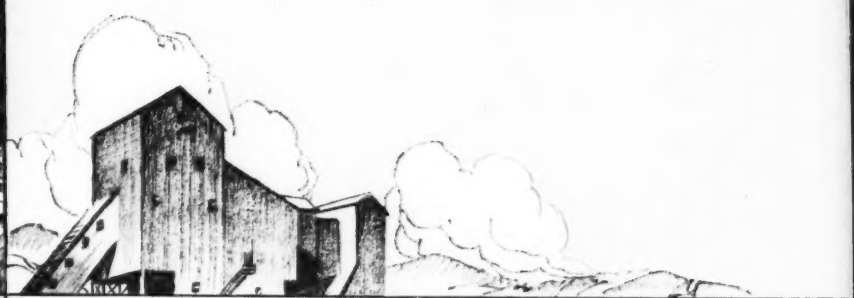

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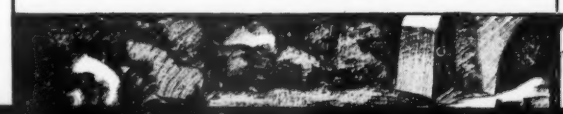

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The Crushed Stone Journal

Official Publication of the NATIONAL CRUSHED STONE ASSOCIATION

J. R. BOYD, Editor

NATIONAL CRUSHED STONE ASSOCIATION

1735 14th St., N. W.
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THE
CRUSHED STONE JOURNAL
WASHINGTON, D. C.
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Plans for Twenty-second Annual Meeting Near Completion

THE Twenty-Second Annual Convention of the National Crushed Stone Association which will take place at the Netherland Plaza Hotel, Cincinnati, Ohio, on January 30, 31 and February 1, 1939, properly holds the spotlight of attention among crushed stone producers as the time of this instructive and pleasurable occasion approaches. With less than three weeks remaining before President Weston calls the opening session to order on Monday, January 30, the Washington headquarters of the Association is busily engaged in completing arrangements for the meeting and the Manufacturers' Division Exposition which will be held in conjunction with it. Acceptances have now been obtained from practically all of the speakers who have been asked to address the convention. Thirty-eight members of the Manufacturers' Division have contracted for exhibit space in which they will display important improvements and developments in machinery, equipment and supplies used in the production of crushed stone. All indications point to an outstandingly successful meeting. Crushed stone producers from all sections of the country, North, South, East and West, should schedule as the first order of business for 1939 attendance at the annual convention of the industry. Remember: All producers, whether or not members of the National Crushed Stone Association, are cordially and earnestly invited to attend the convention and participate in the proceedings.

It seems to us not without significance that for over twenty years crushed stone producers, under the sponsorship of the National Crushed Stone Association, have been meeting once a year in annual convention. These occasions have proven unique in their ability to afford producers the opportunity of exchanging helpful ideas, of engaging collectively in the solving of common problems, of hearing discussed by eminent authorities subjects of deep and far-reaching significance to the welfare and prosperity of the industry. In the cordial and social atmosphere of the annual meeting, old friendships are renewed and new ones quickly made. No institution can be so long sustained unless there is a real and vital need and the repeated success enjoyed by our annual convention speaks, we believe, more eloquently than words for its increasing value and popularity.

In preparing the program for the coming meeting we have endeavored to profit by the experience of past years, recognizing that those in attendance cover a wide range of interests. Every possible effort has been made to produce a well balanced, comprehensive, and informative program, presented by speakers of outstanding reputation and ability. In the following we shall endeavor to give a brief review of the program as it now stands, confident in the belief that you will find attendance at Cincinnati very much worth while.

Immediately following the call to order and address of welcome by President T. I. Weston who will open the convention at ten o'clock on Monday morning, January 30, the Regional Vice-Presidents of the Association will summarize for their respective regions business conditions in 1938 and the outlook for 1939. These reports on the "state of the industry" are anticipated with real interest as they have become valuable indicators of important industry trends. Following the presentation of the regional reports, H. Gordon Hayes, Professor of Economics, Ohio State University, will outline for us the business picture from the national viewpoint. Prof. Hayes is widely and favorably known as an economist of outstanding merit and his observations should prove not only intensely interesting, but of real value.

The year just concluded has witnessed the undertaking of several highly significant engineering investigations by our Bureau of Engineering. These will be discussed by A. T. Goldbeck and the morning session will conclude with the report of Administrative Director J. R. Boyd.

At the Greeting Luncheon, scheduled to take place at one o'clock, to which everyone at the convention is cordially invited, we shall hear from Hal G. Sours, newly appointed Assistant Director of Highways of the Department of Highways of Ohio. Mr. Sours has been prominent in the highway field for many years and from his extensive experience in handling problems of interest to stone producers can give us a message of real value.

As the opening paper at the Monday afternoon session R. A. Moyer, Associate Professor of Highway Engineering, Iowa State College, will discuss "Skid Resistance of Road Surfaces." The loss of life and limb which annually takes place on our highways has become a problem of national import. As an industry intimately involved in the construction of the nation's highways, it is appropriate that we be fully informed as to the latest developments in making our road surfaces free from skidding. Prof. Moyer has made an intensive study of this subject and his findings should prove not only of interest, but of definite practical value.

Current developments in automotive design have, in the opinion of many of our highway experts, far outstripped those in the field of highway design and if we are to reduce the appalling number of accidents which take place annually on the highways of the country, it would seem that we can begin none too soon to "stream-line" our highway system. This subject will be discussed by Charles M. Upham, Engineer-Director, American Road Builders' Association, who needs no introduction to a crushed stone audience. In connection with Mr. Upham's attendance at the 8th International Road Congress at The Hague this summer he enjoyed the opportunity of studying the stream-lined highways of Germany. Mr. Upham plans to illustrate his talk with a number of slides of photographs obtained while he was in Europe.

Final arrangements have not yet been made for the other speaker on the Monday afternoon program. His name and subject will be included in the advance program which will be mailed within the next few days.

A reception by the Manufacturers' Division to all in attendance at the convention will begin in the Hall of Mirrors at 6:30 Monday evening. Following the reception, a buffet supper will be available at nominal cost. The Manufacturers' Division reception and supper offer an excellent opportunity, among pleasant and congenial surroundings, for manufacturers and producers to get acquainted preliminary to the formal opening of the Exposition which will take place at 8:00 P. M.

Heavy congestion in traffic on many of our present arterial highways, coupled with increasing public demand for high-speed highways between major cities, has in recent years centered attention upon the super-highway. Pennsylvania is now engaged in the construction of such a road, known as the Pennsylvania Turnpike, running from Harrisburg to Pittsburgh. S. W. Marshall who is Chief Engineer of the Pennsylvania Turnpike Commission will open the Tuesday morning session with a talk dealing with this unique piece of highway construction. The road, which is 162 miles in length, will be four lanes in width and follow the roadbed of the South Penn Railroad which was begun many years ago as a rival to the Pennsylvania Railroad but was never finished. Nine partially excavated tunnels will be used which will aggregate seven miles of highway. The construction of this project will mark a new era in the field of highway engineering, and Mr. Marshall's paper should prove of absorbing interest.

Next on the program will be Merton R. Keefe, Chief Engineer of the State Highway Commission of Indiana, who will discuss for us, "Future Highway Development as Related to the Crushed Stone Industry." We can be sure of a talk of exceptional interest from Mr. Keefe. There are few men who have enjoyed a more comprehensive experience in the construction field than he. Mr. Keefe has served with various railroads and for more than twenty years with the Ulen construction organization, being at one time in charge of all foreign construction of that company. None can deny the importance of the subject he will discuss and his talk should prove both interesting and informative.

Concluding the Tuesday morning session we shall hear from our good friend, Col. Willard T. Chevalier, Vice-President of the McGraw-Hill Publishing Co. Col. Chevalier is widely known throughout the industry and can always be relied upon to give an intensely interesting and fascinating talk. It is a privilege to be able again to include him among our guest speakers.

The Manufacturers' Division Luncheon will take place at one o'clock on Tuesday, again affording op-

portunity for manufacturers of equipment and producers to get together socially. From two to five on Tuesday afternoon has been left entirely free to permit the producers in attendance an opportunity to view in a leisurely way the displays of the exposition. May we urge that all companies send to the convention their superintendents and operating men, as at no other time throughout the year can such a large amount of first-hand information be obtained by the operating men with such economy of time and expense. Further, technical advisers to many of the exhibiting companies will be on hand to discuss specific problems with any who may so desire. The members of our Manufacturers' Division go to great lengths to make their exhibits interesting and instructive and full advantage should be taken of this opportunity to keep up to date with developments in the machinery and equipment field.

From 5:30 to 7:00 on Tuesday evening President Weston will hold a reception in the headquarters suite for all in attendance at the convention, at the conclusion of which the Annual Banquet will take place in the Hall of Mirrors. J. B. Hill, President of the Louisville and Nashville Railroad of Louisville, Kentucky, will make the principal address. As his subject he has chosen, "Some Important Aspects of the Transportation Problem." We can confidently anticipate from Mr. Hill, who is well known, especially throughout the South, an address of distinction and merit.

The Wednesday morning session will open with a talk by M. R. Budd, Associate Editor of "The Explosives Engineer" on "The National Crushed Stone Association Safety Contest." Following this Mr. Budd will present the awards to the winners in the 1937 contest. Mr. E. A. Heise, Safety Engineer of the Columbia Quarry Co., will receive the trophy in behalf of his organization which enjoyed the distinction of winning first place in the contest. Parchment reproductions of the award will be presented to representatives of all companies which won honorable mention.

Negotiations are about complete for a paper entitled, "Extending the Use of Agricultural Limestone," to be given following the presentation of the safety awards. We anticipate having a representative of the Agricultural Adjustment Administration who will make special reference to the policy of the Administration which permits, under certain circumstances, grants of material to farmers in lieu of cash payments in connection with the soil conservation program. The making available of agricultural limestone to farmers through direct purchase by the Government involves the solution of a number of rather complex problems which are of vital concern to the marketers of agstone and a discussion along these lines should prove of much interest.

The Wednesday morning session will be concluded with a talk by Whiting Williams on the subject, "Give Us This Day Our Daily Job." Two years ago we had the privilege of hearing Mr. Williams and this time he comes to us with his experience enriched by an extended visit to a number of European countries this summer. While in Europe Mr. Williams actually assumed the role of a worker. He has studied carefully the labor situation as it exists there and is constantly in touch with this problem in our own country. His talk should be as it was before, one of the highlights of the convention.

The opening paper on Wednesday afternoon will be presented by Frederick H. Gross, Assistant Engineer, Park Department, New York City, on the subject, "Limestone Screenings and Stabilized Emulsion as Used in the Development of the Park System in New York City." Constantly seeking, as we are, extended uses for our material, we should hear Mr. Gross' paper with absorbing interest.

With the year just concluded witnessing the passage of much Federal legislation directly affecting industry and with the current session of Congress certain to consider many legislative proposals of possible far-reaching significance to industry, our convention program could hardly be considered complete if we failed to include a survey of the present situation and some idea as to what business may expect in the legislative field. We know of no man better qualified to handle this complex picture than John C. Gall, General Counsel for the National Association of Manufacturers, and it is with real gratification that we are able to announce that he has consented to appear on our program to discuss with us these important matters.

Following Mr. Gall's presentation on "Highlights in the Field of Federal Legislation," a generous allowance of time has been scheduled for floor discussion. Interest will no doubt center around the Wage and Hour Act, Government Contracts Act, and such legislative proposals as the O'Mahoney Federal Licensing Bill. Mr. Gall will be glad to answer specific questions, so come prepared to ask the many questions which are perplexing you. It is our hope and expectation that this phase of our convention program will prove of exceptional value and we wish

to urge that everyone present feel entirely free to take part in the general floor discussion.

Wednesday afternoon's program will be concluded with the general business session at which time reports of the Resolutions Committee, the Auditing Committee, and the Nominating Committee will be acted upon. Following the election of officers the convention will adjourn.

Wednesday evening will be devoted to having a good time through the medium of the Convention Cabaret. Arrangements have been concluded for a floor show of unusual merit, following which there will be dancing. With this the last opportunity for many of us to be together until the convention next year, everyone should definitely plan on the sociability and entertainment on Wednesday evening.

If this brief review does not persuade you that your place is in Cincinnati on January 30, 31 and February 1, it can only be that we lack what it takes to get the idea across because, in all earnestness, we believe the program is an excellent one and that you will find the trip to Cincinnati more than worth while.

In conclusion, let us repeat that all producers are most cordially invited to attend and participate to the fullest degree in our Twenty-Second Annual Convention, whether or not they are members of the National Crushed Stone Association. If you have not already done so, be sure to make your reservations immediately with the Netherland Plaza Hotel direct. A reservation card is included in the front of this issue of the "Journal" for your convenience.

The Use of Stone Screenings for the Treatment of Icy Pavements

AT THIS time of the year the hazard of ice on highways again becomes an important consideration. On grades and curves and particularly at dangerous intersections it is necessary that every possible precaution be taken to protect the traveling public from skidding accidents. It is not feasible to entirely remove ice from pavements and the most effective means for combating slippery conditions is to use a gritty material, so treated that it will embed itself in the ice layer.

Stone screenings possess characteristics which make this material exceptionally efficient for the treatment of icy pavements. They are angular and gritty and, therefore, they offer the highest resistance to skidding, for because of their angularity and sharpness, they become embedded in the ice very readily. Many stone screenings are dark enough in color to readily absorb heat which aids their embedment in the ice. Finally, upon removal of the screenings from the road surface, after thawing has taken place, the used screenings may be applied to the shoulders with excellent effect. Stable shoulders will thus be built up having high load-carrying capacity.

The proper gradation of stone screenings for the treatment of icy pavements is a matter of opinion, but material from ⅛ to ⅜ or ½ inch in size and free from dust should give very satisfactory results. Dust should not be present because this might tend to create a greasy condition which would be of no assistance in preventing skidding. The gritty condition produced by coarser particles however is quite necessary. On the other hand, there is a danger of the larger sizes being thrown by passing vehicles and it is therefore undesirable to use a too large maximum size.

If stone screenings are applied to the ice directly, with no treatment of any kind, they will not embed themselves readily and, therefore, it becomes necessary to use either calcium chloride or sodium chloride solution mixed with the screenings. The use of such solutions has the further advantage of preventing the piles of treated screenings from freezing and they thus may be readily handled when needed. To prevent freezing of the screenings, 25 to 50 lb. of calcium chloride or sodium chloride for each cubic yard of abrasive material should be used. This may be mixed with the screenings, either dry or in solution. Additional calcium or sodium chloride up to the extent of 50 lb. per cu. yd. of stone should be used at the time of treatment. It is highly important, however, that the amount of chemical that is used be kept to the minimum necessary to properly embed the stone in the ice, for, otherwise, concrete surfaces may be harmed through a too great concentration of the salts. Generally, 1½ to 2 lb. of screenings per sq. yd. of surface will be sufficient for anti-skid purposes.

As soon as the ice has melted and the screenings are no longer needed, they should be swept off the surface because excessive damage may result to the road surface due to the grinding action of traffic when the surface is covered with this gritty material and also due to the presence of the chloride solution. Slush ice containing chloride solution should be removed from concrete pavements as soon as practicable.

The Effect of Dust in Stone Sand on the Properties of Mortars

By A. T. GOLDBECK

Engineering Director, National Crushed Stone Association

◆ Stone sand as a fine aggregate in concrete continues to grow in interest and the tests reported in the present article were made to obtain additional information, useful in the writing of proper specifications for this material.

THERE has been a tendency recently to require an increased amount of fines in stone sand and even in natural sand specifications for the ultimate purpose of improving the workability and durability of concrete. But when the fines are increased in the sand there may be other and perhaps objectionable effects produced in concrete. Excessive shrinkage, for illustration, has been suspected in mortar and concrete containing excessive fines, also decreased resistance to freezing and thawing. The present tests were therefore made to gain additional information on the effect of various quantities of dust in stone sand on the properties of mortar such as might be used in highway concrete.

The limestone for making the stone sand used in these investigations is one regularly shipped into Washington. It has a Deval abrasion loss of 3.5 to 4.0 per cent, a Los Angeles rattler loss of 23 per cent and an absorption of a few tenths per cent. Six different percentages of dust were used and the gradations of the sands used were as follows:

TABLE I.

GRADATION OF STONE SANDS USED IN TESTS

Identification	A	B	C	D	E	F
Sieve No.	Total Per Cent Passing					
4	100	100	100	100	100	100
8	97	97	97	97	97	97
16	62	62	62	62	62	62
30	40	40	40	40	40	40
50	20	22	24	26	28	30
100	4	8	12	16	20	24
Fineness Modulus	2.77	2.71	2.65	2.59	2.53	2.47

The dust was not of extreme fineness and had the following gradation:

TABLE II

Total per cent passing	No. 50	100
" " "	No. 100	92
" " "	No. 200	62

Mortars were made with these stone sands in the proportion of one part of Portland cement and 2 parts of stone sand by weight. All mixes were made of the same consistency as determined by a large flow table using 25 ½-inch drops. Flows are expressed in inches increase in diameter of the 4-inch diameter flow cone. The consistency used is about that of the mortar in 1:2:3½ concrete having a 2-inch slump.

Test specimens for each mix consisted of nine, 2-inch cubes and one, 2x2x14 in. beam which was fitted with brass plugs on two opposite sides on a 10-inch gage length. These were later used in conjunction with a Whittemore strain gage for measuring changes in length.

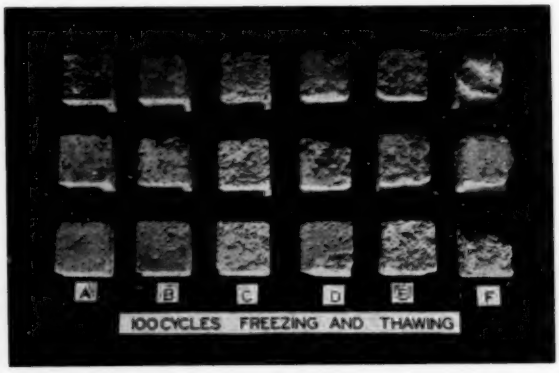
Immediately after mixing the mortar, tests were made for volume of water loss per unit volume of mortar. For this determination a method devised by Mr. E. W. Reid-Lewis was employed. Roughly, it consists of placing the mortar in a 3-inch diameter cylinder 5½ inches deep, covering the top of the mortar with a layer of filter paper, then a layer of fine crushed quartz or "banding sand" into which the excess water is absorbed. Care is taken to prevent loss by evaporation. The increase in weight of the fine crushed quartz is the weight of water lost from the mortar. The test gives some idea of the tendency of the mortar toward "water gain" during the settlement of the fresh mortar or concrete.

Shrinkage of the mortar was obtained volumetrically from the "water gain" specimen after settlement had ceased. For this determination mercury was poured on top of the specimen and covered with plate glass so as to exactly fill the volume produced by settlement at the top of the mold. Except for the influence of variable escape of contained air from the different specimens, the volume of water lost should equal the decrease in volume of the mortar. The decrease in volume is useful in comparing the relative settling tendencies of different mortars and concretes.

The mortar cubes were stored 24 hours in the moist room and 27 days in water. Three cubes of each mix were then tested in compression; three were tested for absorption, and three were subjected to 100 cycles of freezing and thawing.

In determining absorption, the specimens were weighed at the end of 27 days in water and were then oven dried to constant weight at approximately 220° F. The loss in weight was taken as a measure of absorption.

Freezing and thawing tests were begun after 28 days using an ice cream type of freezing apparatus



and with specimens partially immersed. The loss in weight at the end of 100 cycles of freezing and thawing is taken as a measure of relative durability.

In Table III are shown the results of the tests above described:

TABLE III

Identification	A	B	C	D	E	F
Percent of minus No. 100 Dust	4	8	12	16	20	24
Quantities per unit Volume of mortar						
Cement	.205	.204	.203	.203	.203	.202
Sand	.472	.470	.468	.468	.468	.464
Water	.295	.298	.301	.300	.300	.307
Air	.028	.028	.028	.029	.029	.027
Vol. of water loss per unit vol. of fresh mortar	.020	.017	.019	.014	.016	.020
Volumetric shrinkage per unit vol. of fresh mortar	.014	.018	.016	.016	.015	.020
Flow	11.0	10.9	11.0	10.9	11.1	11.1
W/C by volume	0.68	0.69	0.70	0.70	0.70	0.72
Compressive strength, p.s.i. 28-day	9940	9040	9410	9030	9050	8930
*Absorption, %	7.6	7.9	9.2	9.4	9.8	10.2
Freezing and Thawing 100 cycles, per cent loss	1.8	5.1	8.2	8.6	11.3	26.8

p.s.i. = pounds per sq. in. W/C = water-cement ratio.
*Obtained by oven drying to constant weight after immersion in water for 27 days.

Discussion of Results in Table III

Volume of Water Loss per Unit Volume of Fresh Mortar. It will be observed that the water loss was about the same for all the mortars containing from 4 up to 24 per cent of minus No. 100 dust in the sand. There was some variation, perhaps due to experimental errors, but it seems that the dust had no well-defined influence on the release of water from the mixture.

Volumetric Shrinkage. The volumetric shrinkage should be almost equal to the volume of water lost and except for variable air losses this should be exactly true. There is a fair correspondence—the variation is perhaps influenced by unavoidable errors in the method. In any event the difference in settlement due to increasing amounts of dust is not great.

Water-cement Ratio. Because of increased surface area due to increased dust content it might be expected that a very great increase in water-cement ratio would result as the dust is increased. Actually, however, although there was some additional water required for the high dust content mixtures, the increase was not great. Thus, although 0.68 water-cement ratio was required when 4 per cent dust was used in the sand, the sand containing 24 per cent of dust required only 0.72 water-cement ratio to produce the same consistency, an increase in water-cement ratio of only 0.04.

Compressive Strength. The slight increase in water-cement ratio was, however, reflected in somewhat decreased strengths but not enough decrease to be serious.

Absorption. There is a well defined trend toward higher absorption values as the dust content is increased, ranging from 7.6 per cent absorption for 4 per cent dust to 10.2 per cent for 24 per cent dust.

Freezing and Thawing. The freezing and thawing tests indicate that a high percentage of dust may be decidedly harmful to the resistance of this type of mortar to the weather, as indicated by the percentage of loss after 100 cycles of freezing and thawing. It would seem inadvisable to use more than 8 to 10 per cent of minus No. 100 sieve limestone dust in the stone sand used for concrete to be exposed to the weather.

Expansion and Contraction Measurements. If concrete shrinks excessively upon drying, cracks are apt to develop in concrete roads and in structures and, accordingly, it becomes pertinent to inquire if large amounts of stone dust in the fine aggregate affect the shrinkage properties of the mortar.

To determine the shrinkage of the different mortar specimens, as previously mentioned, brass gage plugs were set on two opposite sides of 2 x 2 x 14 inch mortar specimens made of the mixtures described in Table I. These plugs were set on a 10-inch gage length for use with the Whittemore strain gage.

The first readings were taken when the specimens had been moist cured for 7 days and all subsequent readings are compared with this original set. The specimens were water-cured for 55 days, after which at the age of 62 days, they were weighed and placed on a rack to dry in the air of the laboratory. Weight and contraction readings were taken at various intervals of time until the specimens had been exposed to the air of the laboratory for about one year. The results of this test are best seen in Table IV.

TABLE IV

RELATIVE MOVEMENT DUE TO MOISTURE AND DRYING BASED ON CONDITION AT 7 DAYS OF MOIST CURING.

Identification			A	B	C	D	E	F
Total Age, Days		Storage Condition	Movement 1/100,000 inch per inch					
7		Moist air	0	0	0	0	0	0
28		Water	+2	+4	+2	0	+2	+2
51		"	+3	+3	+2	+1	+2	+2
62		"	0	+2	0	+1	0	0
63	(1)	Air of laboratory	—3	—2	—4	—4	—2	—4
66	(4)	"	—24	—24	—28	—27	—24	—26
69	(7)	"	—36	—33	—36	—36	—33	—34
73	(11)	"	—44	—42	—45	—46	—42	—43
82	(20)	"	—60	—57	—59	—60	—58	—58
172	(110)	"	—100	—97	—100	—100	—100	—99
184	(122)	"	—97	—94	—98	—100	—97	—96
416	(354)	"	—106	—102	—105	—106	—104	—102
Percent water loss after 62 days wet storage then dried in air								
63	(1)	"	.7	.7	.8	.8	.7	.9
66	(4)	"	1.7	1.7	1.8	1.7	1.7	1.9
69	(7)	"	2.0	2.1	2.3	2.3	2.2	2.5
73	(11)	"	2.3	2.3	2.5	2.6	2.4	2.7
82	(20)	"	3.0	2.9	3.2	3.2	3.1	3.5
172	(110)	"	5.1	5.1	5.4	5.5	5.5	5.9
184	(122)	"	5.1	5.2	5.4	5.6	5.5	6.0
416	(354)	"	6.0	6.1	6.2	6.3	6.4	6.7

+ = expansion — = contraction

NOTE: Figures in parentheses show number of days stored in air.

At the end of 354 days of drying the unit shrinkage was practically alike in all cases, namely, 0.00102 to 0.00106 inches. The percentage of loss in weight of the various specimens upon drying in air for 354 days was not greatly different and ranged from 6.0 for 4 per cent dust to 6.7 for 24 per cent dust in the stone sand.

The conclusion may be drawn from this test that up to 24 per cent of minus No. 100 dust in the sand does not affect the amount of shrinkage due to drying.

Conclusions

The following brief summary of indications from the present tests seems warranted:

1. To maintain a given consistency in mortars containing dust varying in amount from 4 up to 24 per cent, very little increase in water-cement ratio is required.

2. Neither the volume of water released upon settlement of the fresh mortar nor the volumetric shrinkage of the fresh mortar is affected to a significant extent by an increase in dust content up to 24 per cent.

3. Crushing strength of mortar is somewhat decreased with increasing percentages of dust. The crushing strength of the 24 per cent dust content mortar was 90 per cent of that containing only 4 per cent dust.

4. The absorption increases with increasing percentages of dust.

5. The durability seems to be affected to a significant degree by high percentages of dust, far more than can be accounted for by the rather slight increase in water-cement ratio required to maintain the same consistency.

6. The shrinkage of mortar upon drying out in the air is practically unaffected by the dust content in the sand.

Although the above tests were made on mortar, it is to be expected that concrete will be similarly affected only to a different extent and hence these tests are applicable qualitatively to concrete also. Finally, it seems safe for concrete containing 1:2 mortar to have at least 8 to 10 per cent of stone dust passing the No. 100 sieve. Only one limestone sand and dust was used in the present tests and it is not improbable that the other sands and dusts might give results varying somewhat from these.

Recent British Investigations on Effect of Dust in Crushed Granite Aggregate

The following quotation is taken from the Report of the Road Research Board, Department of Scientific and Industrial Research of Great Britain.

"Effect of Dust in Crushed Granite Aggregate.—In practice, a crushed aggregate would probably contain a certain proportion of dust or material passing British Standard Sieve No. 100. In order to determine the effect of the presence of this fine material a number of mixes were prepared using Penmaenmawr granite of the four standard gradings but containing various amounts of dust. These were tested for workability and crushing strength.

"It was discovered that the presence of quite large amounts of dust was not detrimental as regards workability and in certain cases, such as with a coarsely graded aggregate, even proved beneficial. Taken as a whole, the results indicate that the quantities of dust shown in Table 3 should be taken as

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The Public's Interest in Industrial Peace

Hon. EDWARD R. BURKE
United States Senator from Nebraska

◆During the current session of Congress much will be heard concerning possible amendments to the National Labor Relations Act. Senator Burke has been a consistent opponent of certain provisions of the Act and will undoubtedly lead the effort in the Senate for amendments. His observations on this important subject should prove of vital interest to every employer.

THIS is a time for serious thinking concerning the rights and privileges, the obligations and responsibilities, of all factors who have a part in the industrial life of America. That society in this day has reached a new conception of the relationship that ought to prevail between employes and employers, let no one doubt. It will not further tolerate any policies of *industry* that are unfair and oppressive to those who toil in mill and factory. Nor will society much longer permit disruption of industry because of unreasonable demands of self-seeking *labor* leaders. The public has too deep an interest in industrial peace to sanction a constant state of turmoil. Furthermore, that *government* touches the entire industrial process in a far more intimate and controlling manner than heretofore, is clear beyond the necessity of proof.

It is essential that employers, employes, and government, each reconsider its position and determine whether it has in all respects been following the correct course. There should be prompt and cheerful acceptance of whatever changes are required. Eliminating, as far as possible, recrimination and abuse, putting aside all preconceived notions and ideas, each of the three parties,—*management, labor* and *government*—should proceed with singleness of purpose. The goal is clear. How may industry best serve society in the production of quality goods at fair prices, affording fullest measure of employment at the highest possible wage earned by reasonable hours of effort under proper conditions of work, and still assure an adequate return to management and those who risk the necessary capital.

Management, using the term in its broader sense, must recognize the new obligations that this age requires of it in its dealings with labor. The old days of complete employer domination, with all of the good and the evil that were involved, are now a thing of the past. Splendid examples of the highest type of industrial leadership have always been present far greater in number than unjust critics of our economic system have been willing to admit. Industries that have lagged behind must be brought into line. Out of this Congress of American Industry, and like associations, may well come the inspiration that will point the way to accomplishment of present day requirements.

At this time, I mention one specific matter only. Collective bargaining has become an essential of modern industrial development. It is the only apparent substitute for that personal contact between the boss and the worker that prevailed in a simpler era. There appears no other means to an approach to equality in bargaining power. It is, therefore, the duty of all employers to scrupulously abstain from every course of conduct that could in anywise be construed as an attempted interference with the right of employes to organize for collective bargaining in any manner they see fit. There should be displayed throughout industry a cheerful willingness to bargain openly and fairly with the duly accredited representatives of workers. When agreements have been reached, it goes without saying, that they should be observed to the letter—by both sides.

Labor, organized and unorganized, must be ready to do its part. Radical and misguided leadership should be renounced. Weapons of violence and intimidation discarded. A larger measure of statesmanlike leadership is required. No calling offers a greater opportunity today than is presented to the individual who possesses the qualifications to serve in the front rank of the movement to insure full justice to the workers of the country. It is self-evident that collective bargaining cannot bring fullest benefits unless the representatives selected to bargain for labor have the knowledge, the skill, and the ability to properly represent those for whom they speak.

If collective bargaining is to be a success there must be ready acceptance of the basic truth that there can be nothing worth bargaining for unless industry can be made to succeed. Only when that is assured can there be any chance for permanently higher wages, shorter hours, better working conditions, or a fair measure of profit.

Equally clear, industry cannot possibly succeed unless there is a unity of purpose, fair dealing, and a constant spirit of cooperation, on the part of all

those who contribute their labor, the service of management or the requisite capital. There must be a cheerful willingness by all to deliver the best that is in him in order that the combined effort may produce the greatest good.

There is a lesson we may well learn from the practice of collective bargaining in England. I speak now of only one feature. When the representatives of labor and of management there sit down together, utmost care having first been exercised on both sides to secure the ablest representation, they have a formula that deserves mention. They proceed with the conviction that labor is never *cheap* to any employer if because of a low standard of living that labor is inefficient.

Present in the minds of all is the further definite belief that there is no chance to maintain a high standard of living for labor if the cost of that labor per unit of product is so high as to render that product not readily salable in the markets of the world.

I repeat: If wages are so low, if hours of labor are so long, if working conditions are so unsatisfactory as to render labor inefficient, then that is not cheap labor, no matter how small the pay envelope may be. On the other hand, if the demands of labor have been effective in such degree as to increase the cost of the product to the point where it cannot be readily sold, industry of necessity will be unable to establish a high standard of living for its workers.

With full realization of these basic considerations, and in a spirit of friendly cooperation, collective agreements are today being voluntarily made in England, and faithfully observed.

We come now to the third factor, government. It is of the role of government in the relationship between employed and employer, that I would speak in somewhat greater detail. For the time is certainly at hand when government must reconsider its position. If mistakes have been made in establishing and administering a national labor relations policy, there must be no hesitation on the part of government in retracing its steps. That grievous wrongs have been perpetrated in the name of a government consecrated to liberty and dedicated to fair dealing between citizen and citizen, is now the widely accepted belief from one end of the country to the other. That such belief is fully justified by the facts, I have not the slightest doubt.

Let me say at once that there may have been sufficient justification for the national government to feel that it was under obligation to intervene in order to insure to workers freedom from interference with their right of organization for collective bargaining. I am satisfied that the evil of employer interference has been greatly exaggerated. Nevertheless, many employers were slow to recognize the changed conditions that demanded absolute freedom of workers in this respect.

It should be said, also, that mistaken policies and ruthless conduct of some labor leaders contributed to the reluctance of industry to go voluntarily along this line. There was fault on both sides. Both have learned a lesson. Little is to be gained now by dwelling on the evils of yesterday. In getting rid of those evils, we acquired some new ones, even worse than the old.

The declared objective of the National Labor Relations Act is to diminish the causes of labor disputes. The theory on which the law was drafted was that labor troubles in the past were due exclusively to the refusal on the part of employers generally to enter into the process of collective bargaining, and to interference by employers with the right of their workers to organize for the purpose of choosing representatives to bargain for them.

Accordingly, the Act denounces as unfair labor practices many things that some employers were alleged to be doing, or might do, that would amount to coercion or intimidation of workers. A Board with sweeping powers of investigation and prosecution was set up. Unfortunately, it was likewise vested with full judicial power, save only that it must compel compliance with its orders through court action.

Either because of defects in the law, or in its administration, or both, there has been produced a result directly contrary to the end sought. Instead of diminishing the causes of labor disputes, the enforcement of this Act has multiplied such causes. The Board has so used its tremendous powers as to harry and harass every employer of labor in the country that it could bring within its reach.

It has stirred up strife in institutions where industrial peace has long prevailed. It has set workers at each other's throats, and erected barrier between honest labor and well-intentioned management. It has been a costly experiment for all concerned. If the law is to remain unchanged on the statute books the title, in all fairness, should be changed to read:

> "An Act to Increase Labor Troubles, to Spread Unemployment, and to Disrupt Industry."

The public has a vital interest in industrial peace. The test of a national labor relations policy should be whether it tends to foster good will between workers and management, whether it offers an incentive to fair dealing on both sides and fixes responsibility for a breach thereof. Measured by that test, the present law stands in need of vital changes, and a different type of administration is clearly an immediate requirement.

There are still those who contend that the policy set forth in the Act, and its administration as well, must be all right because of the record of court affirmances, of which the Board and its defenders are so ready to boast.

Such a contention deceives few people. It is too generally understood that courts do not pass upon the wisdom of legislation, nor, except in a limited sense, and in this case exceptionally limited, upon the manner in which laws are administered. A law may be short-sighted, dangerous, altogether ill-adapted to accomplish a declared objective; its administration may be biased and in other respects most objectionable; all of that may be true and yet the aggrieved citizen may be altogether without adequate relief in a court of law or equity.

For changes in the national policy, the citizen must look not to the courts but to Congress. For complaints against the method of administration of a law, the citizen must in general hold responsible, not the courts, but the Chief Executive.

What is wrong with this law? I shall be general in my statements. Specific amendments will be presented to Congress at the approaching session, and it now appears with some reasonable chance of favorable consideration. In the first place, the wording of the Act is such as to have made it possible for a biased administrative agency to put the government in the business of sponsoring national unionization of all industrial workers in the country. That is a far cry from the belief that each individual worker should be left entirely free to settle for himself the question whether he wanted to join a union at all, and if so, whether he preferred an independent or a national union, and if the latter what particular type.

It has made it possible for forceful organizers to sign up untold thousands of workers upon the plea, very hard to resist—"Your government wants you to join this particular union. Your President wants you to come in with us."

Workers themselves are coming to see, in increasing number, that if today unionization is encouraged and sponsored under government patronage, tomorrow government may assert the right to discourage or prohibit union membership altogether. That very thing has happened elsewhere. It might happen here.

In any event, a far safer and sounder program is for the government to keep hands off, to abstain from taking any part or exerting any influence, to leave the workman entirely free to settle that question for himself. The Act should be amended that no labor board, whatever its bias, would have it within its power to put the government into business of fostering, promoting, compelling, unionization of workers.

Congress should reconsider the "majority rule" provisions of the National Labor Relations Act. As it stands, if any union is given authority by a majority of the workers in an "appropriate unit for collective bargaining," as determined by the Board, then that union shall be the sole bargaining agent for all of the workers in that unit in dealing with rates of pay, hours of labor, and other working conditions. As interpreted by the Board, majority means plurality—one more than votes for any other union. If two unions are contesting for this tremendous power, a clear majority of the workers may not want to affiliate with either. Yet that group in the minority which leads its opposition by a single vote, becomes the sole bargaining agent for the almost equal minority opposition, and for the majority that wanted neither. It speaks for all. Moreover the groups not included have no chance to be heard, no chance to argue, not even the opportunity to be present when their vital rights are being settled. That is too much power to place in the hands of any persons. It borders on slavery for those not represented. There must be a change.

Employers should have the same rights under the Act as the other party to the relationship. Since the employer must bargain with the representatives certified by the Board, and with none other, he should be free to call upon the Board at any time of doubt to determine, by election if necessary, which is the proper bargaining agency.

I am convinced that all judicial power should be taken from the Board. It has demonstrated conclusively that in this intimate and vital matter of labor relationship, where feelings run high, it could not, if it would, be wholly impartial. It has made no effort along that line. Its duties should be confined to the investigation of complaints and if reasonable

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Further Attempts at Standardization of Sizes of Coarse Aggregates

UNDER date of June 10, 1936, the Division of Simplified Practice of the United States Department of Commerce approved Simplified Practice Recommendation R163-36 which deals with a recommendation for the standardization of sizes of coarse aggregates including crushed stone, gravel and slag. The crushed stone industry has been supplied with copies of that Simplified Practice Recommendation.

Attempts at the development of a set of standard sizes applicable to the entire country have been under way for a great many years, but these attempts have been encompassed with many difficulties which seemed to be almost insurmountable. Years ago the sizes of aggregates were stated, not only in terms of laboratory screens, but also in terms of plant screens. Furthermore, the laboratory screens in some parts of the country had round openings and in other parts, square openings were used. There was no uniform method of designating sizes. So-called No. 1 size meant large material in one geographical section and small material in another. Such terms as "ballast," "macadam," "concrete aggregate," etc., were used to designate certain sizes in one locality, but other sizes in others. Naturally, under these circumstances it was a hopeless task to bring about standardization of sizes of coarse aggregates.

Gradually it became understood that the designation of sizes in terms of plant screens was entirely inconsistent, for the conditions under which the screen was operated greatly influenced the actual size of the material produced. Accordingly, laboratory screens became quite universally specified for the determination of the size of coarse aggregate. But, unfortunately, two different shapes of openings were in more or less universal use, round and square. A square opening sieve allows larger size material to pass than does a round opening sieve of the same nominal diameter. Therefore, another obstacle which had to be hurdled, concerned itself with the acceptance of either one or the other shape of opening for the specification of size of aggregate.

Those concerned most with the use of concrete aggregates favored the square opening, while those dealing with aggregates for use in bituminous construction favored the round opening sieve; they had used this sieve for many years and were familiar with the size of aggregate measured in this manner. It became necessary to choose between the round and square opening and gradually sentiment drifted in favor of the square opening sieve as the proper device for measuring size of aggregate. One of the principal reasons for this trend is the necessity for using square openings for the measurement of the finer sizes of aggregates and the consequent necessity for using the same shape of opening for coarse aggregates if a uniform measure was to be adopted for both fine and coarse materials. Other reasons which need not be discussed here were also influencing factors in this trend toward the use of square openings. The fact is, although there still are some States using round opening sieves, the specifications of national organizations and of many State highway departments are now written in terms of square openings. It seems logical therefore to standardize on the square opening as the proper measure of size.

Simplified Practice Recommendation R163-36 contains two groups of sizes, Group A having five primary sizes and a number of combined and modified sizes produced from the primary sizes by combination or modification. Group B has six primary sizes and a number of modified and combined sizes. At the time that the simplified practice recommendation was written, it was considered desirable to have two different groups of sizes to best accommodate those in use in different sections of the country. It was soon found in practice, however, that although certain State highway departments specified essentially those sizes given in Recommendation R163-36, unfortunately they did not feel that they could select the sizes they needed from one group only. They felt that they had to use sizes from both groups to get material which exactly suited their needs. Obviously, since these two groups of sizes require different plant screens for making the separations, this intermingling of groups forced a hardship on many plants, for, in part at least, they had to make two different sets of primary sizes. To partially overcome this difficulty an attempt is now

TABLE I
PROPOSED REVISED SIZES OF COARSE AGGREGATES

Size Number Proposed	Size Number R163 Std.	Nominal Size Sq. Openings	Amounts finer than each sieve (square openings), percent by weight													
			3½ in.	3 in.	2½ in.	2 in.	1½ in.	1 in.	¾ in.	½ in.	⅜ in.	No. 4	No. 8	No. 16	No. 50	No. 100
1	12B	3½"-1½"	90-100 [1]		25-60		0-15		0-5							
2	2B	2½"-1½"		100	90-100	35-70	0-15		0-5							
24	23B	2½"-¾"		100	90-100		25-60		0-10	0-5						
3	2A	2"-1"			100	90-100	35-70	0-15		0-5						
357	234A	2"-#4			100	95-100		35-70		10-30		0-5				
4	3B	1½"-¾"				100	90-100	20-55	0-15		0-5					
467	345B	1½"-#4				100	95-100		35-70		10-30	0-5				
5	3A [2] (Mod)	1"-⅜"					100	90-100	40-75	5-30	0-5					
57	34A	1"-#4					100	90-100		25-60		0-10	0-5			
6	....	¾"-⅜"						100	90-100	10-35	0-5					
67	45B	¾"-#4						100	90-100		20-55	0-10	0-5			
68	45B (Mod)	¾"-#8						100	90-100		30-65	5-25	0-5			
7	4A [2] & 5B [2]	½"-#4								100	60-85	0-15	0-5			
8	4A [2] (Mod) & 5B [2] (Mod)	½"-#8								100	65-90 [3]	10-30	0-8			
9	....	⅜"-#8								100	95-100	40-80	0-25	0-10		
10	6B	#4 [3]-0									100	85-100				10-30
G1 [4]	G1 [4]	1½"-#50					100	80-100		50-80		20-40	15-35	5-25	0-10	0-2
G2 [4]	G2 [4]	1½"-#8					100	65-100		35-75		10-35	0-10	0-5		
G3 [4]	G3 [4]	1½"-#4					100	60-95		25-50		0-15	0-5			

[1] 100% finer than 4 inches. [2] Slightly changed. [3] Screenings.

[4] The requirements for grading depend upon the percentage of crushed particles in gravel. Size G1 is for gravel containing 20 percent or less of crushed particles; size G2 is for gravel containing more than 20 percent and not more than 40 percent of crushed particles; size G3 is for gravel containing crushed particles in excess of 40 percent.

[5] The sentiment of the meeting of the Special Committee of the Division of Simplified Practice on December 2, 1938, favored changing this value to correspond as nearly as possible with old size 5B modified, namely 90-100.

TABLE II
TYPICAL USES FOR VARIOUS SIZES

Nominal Size / Size Number	3½"-1½" 1	2½"-1½" 2	2½"-¾" 24	2"-1" 3	2"-#4 357	1½"-¾" 4	1½"-#4 467	1"-⅜" 5	1"-#4 57	¾"-⅜" 6	¾"-#4 67	¾"-#8 68	½"-#4 7	½"-#8 8	⅜"-#8 9	#4-0 10	G-1 G-2 G-3
Use																	
Water Bound Macadam Coarse Aggregate	x	x		x													
Filler																x	
Bituminous Macadam, Pentration Method Coarse Aggregate	x	x		x													
Choke								x		x	x		x				
Seal														x			
Bituminous Plant Mixes: [1] Base or Surface Course																	
Base, Open Mix				x		x											
Base, Closed Mix					x		x		x								
Binder Course									x		x						
Surface Coarse, Coarse Gr.								x	x		x						
Surface Course, Fine Gr.													x	x	x		
Seal													x	x	x		
Bituminous Road Mix Mixing Course								x			x						
Choke													x				
Seal														x	x		
Drag Leveling Course Leveling Course											x	x	x				
Seal														x	x		
Bituminous Surface Treatments										x		x	x	x	x		
Portland Cement Concrete	x	x		x	x	x	x		x		x		x				
Railroad Ballast Stone or Slag			x	x		x		x									
Gravel																	x
Roofing Granules													x	x			

[1] For plant mixes the aggregate should consist of appropriate sizes selected from Table 1 combined with suitably graded fine aggregate.

being made to still further simplify the sizes of coarse aggregates.

At the present time the new table of sizes is being given consideration by the standing committee set up by the Division of Simplified Practice to study this matter so that further modifications might be made before submitting the proposed new table of sizes to consumers and to the industry for their recommendations. It is highly desirable, however, that the crushed stone industry in common with the other aggregate industries be given preliminary information as to the sizes being studied so that the committee may gain the benefit of comments from these industries for their further guidance. *Accordingly, the following tables are now presented with the urgent request that the crushed stone industry submit criticisms and suggestions to the National Crushed Stone Association,* the Engineering Director of which holds membership on the Standing Committee of the Division of Simplified Practice.

Table I shows the suggested sizes stated in terms of square opening laboratory screens and Table II suggests the uses for these different sizes.

The Public's Interest in Industrial Peace

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cause is found, prosecution in the appropriate court. The American citizen has the deep-seated conviction that he is entitled to his day in court. He will never be satisfied that he has had it unless he can look into the face of a judge who is known to be impartial, fair-minded, seeking only to administer justice between man and man, and not a fanatical advocate of some certain theory that is supposed to bring about a new order or system in our economic life.

Above all, the administration of the Act must be placed in the hands of men who are actuated by one purpose only, and that is so fairly, and with such understanding and infinite patience, to enforce the law as to bring the utmost good will into the labor relationship. That is not being done today. There is complete failure in that respect. Because the public has so deep an interest in industrial peace, the approaching session of Congress will have before it no problem more worthy of serious consideration than changing the national labor relations policy.

The Effect of Dust in Stone Sand

(Continued from page 9)

the maximum allowable in a 1:6 mix, the dust being included in the six parts of aggregate.

"The dust was that formed during crushing and was separated out during the sieving and grading processes. It should, of course, not be assumed that all dusts would produce similar results.

TABLE 3

MAXIMUM QUANTITIES OF CRUSHER DUST PERMISSIBLE IN AGGREGATE (PENMAENMAWR GRANITE) FOR CONCRETE.

	Maximum Quantity of Crusher Dust	
Workability Required	As percentage of fine aggregate (i.e., less than 3/16 in.)	As percentage of total aggregate
Low	20	6 to 10
Medium	30	9 to 15
High	40	12 to 20

"All tests so far carried out indicate that for a constant value of water-cement ratio the strength of concrete when fully compacted is practically unaffected by the presence of the above amounts of dust. This is shown in Table 4."

TABLE 4

STRENGTH OF CONCRETE CONTAINING CRUSHER DUST (PENMAENMAWR GRANITE)

Amount of Dust by weight		Water-cement ratio by weight		
		0.70	0.80	0.90*
As percentage of fine aggregate	As percentage total aggregate	Compressive strength of 1:6 mix at 7 days in lb./sq. in.		
0	0	2695	2010	1430
10	3 to 5	2710	2025	1515
20	6 to 10	2700	2135	1500
30	9 to 15	2707	2103	1620
40	12 to 20	2680	2065	1660

*A water-cement ratio of 0.90 is outside the normal range of practical use for a 1:6 mix.

It will be noted from the above that even very high percentages of dust in the fine aggregate had no effect on the crushing strength. This is not greatly at variance with our own tests which showed 10 per cent decrease in compressive strength in mortar containing 24 per cent dust as compared with that having 4 per cent. The British report does not treat of the effects of dust on other properties of water or concrete.

MANUFACTURERS' DIVISION of the NATIONAL CRUSHED STONE ASSOCIATION

Allis-Chalmers Mfg. Co.
Milwaukee, Wis.
Crushing, Screening, Washing, Grinding, Cement Machinery; Motors; Texrope Drives; Centrifugal Pumps; Tractors

American Bitumuls Co.
200 Bush St., San Francisco, Calif.
Bitumuls—Hot and cold mixes, Penetration and Stabilization

American Cyanamid & Chemical Corp.
Explosives Department
Koppers Building, Pittsburgh, Pa.
Explosives and Blasting Supplies

American Manganese Steel Division of the American Brake Shoe and Foundry Co.
389 E. 14th St., Chicago Heights, Ill.
Manganese Steel Castings, Renewable Lip Dippers

The American Pulverizer Co.
1249 Macklind Ave., St. Louis, Mo.

Atlas Powder Co.
Wilmington, Del.
Industrial Explosives and Blasting Supplies

Audubon Wire Cloth Corp.
Philadelphia, Pa.

Earle C. Bacon, Inc.
17 John St., New York City
Primary and Secondary Crushers, Rolls, Screens, Elevators, Conveyors—Complete Plants designed and equipped.

The Barrett Co.
40 Rector Street, New York City
Tarvia and Tarvia-lithic for Road Construction, Repair and Maintenance

Brooks Equipment and Mfg. Co.
408-10 Davenport Road, Knoxville, Tenn.
"Brooks Load Jugger" (Stone Hauling Equipment). DAY Jaw Type Rock Crushers. DAY Pulverizers, or "Swing Hammer" Crushers

C. G. Buchanan Crushing Machinery Division of the Birdsboro Steel Foundry and Machine Co.
90 West Street, New York City
Primary, Secondary and Finishing Crushers and Rolls

Bucyrus-Erie Co.
South Milwaukee, Wis.
Excavating, Drilling and Material Handling Equipment

Cross Engineering Co.
Carbondale, Pa.
Screen Plates and Sections, Perforated Plate, for Vibrating, Rotary and Shaking Screens

Dempster Brothers, Inc.
Box 3063, Knoxville, Tenn.
DempsteR
DumpsteR

E. I. du Pont de Nemours & Co., Inc.
Wilmington, Del.
Explosives and Blasting Accessories

Easton Car and Construction Co.
Easton, Pa.
Quarry Cars, Truck Bodies and Trailers
Electric Heaters for Tar, Asphalt or Bitumen

Ensign-Bickford Co.
Simsbury, Conn.
Cordeau-Bickford Detonating Fuse and Safety Fuse

Frog, Switch & Mfg. Co.
Carlisle, Pa.
Manganese Steel Department—Manufacturers of "Indian Brand" Manganese Steel Castings for Frogs, Switches and Crossings, Jaw and Gyratory Crushers, Cement Mill, Mining Machinery, etc., Steam Shovel Parts

General Electric Co.
1 River Road, Schenectady, N. Y.
Electric Motors

Goodyear Tire & Rubber Co.
Akron, Ohio
Belting (Conveyor, Elevator, Transmission), Hose (Air, Water, Steam, Suction, Miscellaneous), Chute Lining (Rubber)

Gruendler Crusher and Pulverizer Co.
2915 N. Market St., St. Louis, Mo.
Rock and Gravel Crushing and Screening Plants, Jaw Crushers, Roll Crushers, Hammer Mills, Lime Pulverizers

Hardinge Co., Inc.
York, Pa.
Scrubbers, Pulverizers, Dryers

Hayward Co.
50 Church Street, New York City
Orange Peel Buckets, Clam Shell Buckets, Drag Line Buckets, Electric Motor Buckets, Automatic Take-up Reels

Hendrick Mfg. Co.
Carbondale, Pa.
Perforated Metal Screens, Perforated Plates for Vibrating and Shaking Screens, Elevator Buckets, Hendrick Vibrating Screens

Hercules Powder Co.
Wilmington, Del.
Explosives and Blasting Supplies

Illinois Powder Mfg. Co.
1752 Pierce Bldg., St. Louis, Mo.
Gold Medal Explosives

International Harvester Co.
108 N. Michigan Ave., Chicago, Ill.

The Jeffrey Mfg. Co.
Columbus, Ohio
Material Handling Machinery, Crushers, Pulverizers, Screens, Chains

Kelbar Powder Co.
200 W. 9th St., Wilmington, Del.
All Blasting Requirements

Kennedy-Van Saun Mfg. and Eng. Corp.
2 Park Ave., New York City
Material Handling Machinery—Crushers, Pulverizers, Vibrating Screens

Kensington Steel Co.
505 Kensington Ave., Chicago, Ill.
Manganese Steel Castings, Dipper Teeth, Crawler Treads, Jaw Plates, Concaves and Hammers

Koehring Co.
3026 W. Concordia Ave., Milwaukee, Wis.
Mixers, Pavers, Shovels, Cranes, Draglines, Dumptors, Traildumps, Mud-Jacks

Koppel Division, Pressed Steel Car Co., Inc.
2515 Grant Bldg., Pittsburgh, Pa.
Air Dump Cars, Quarry Cars, and Portable Railway Materials

Lima Locomotive Works, Inc.
Shovel and Crane Division
1108 Lima Trust Bldg., Lima, Ohio
Power Shovels, Draglines and Cranes

Link-Belt Co.
300 West Pershing Road, Chicago, Ill.
Complete Stone Preparation Plants. Conveyors, Elevators, Screens, Washing Equipment, Speed-o-Matic Shovels—Cranes—Draglines and Power Transmission Equipment.

Ludlow-Saylor Wire Co.
Newstead Ave. & Wabash R. R., St. Louis, Mo.
Woven Wire Screens and Wire Cloth of Super-Loy, Manga-Loy and all commercial alloys and metals

Marion Steam Shovel Co.
Marion, Ohio
A Complete Line of Power Shovels, Draglines and Cranes

McLanahan and Stone Corp.
Hollidaysburg, Pennsylvania

Manganese Steel Forge Co.
Richmond St. and Castor Ave.,
Philadelphia, Pa.

National Powder Co.,
Eldred, Pa.
Commercial Explosives and Blasting Accessories

The National Supply Co. of Delaware,
Superior Engine Division,
1401 Sheridan Ave., Springfield, Ohio
Diesel engine equipment

Nordberg Mfg. Co.
Milwaukee, Wis.
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Northern Blower Co.
6409 Barberton Ave., Cleveland, Ohio
Dust Collecting Systems, Fans—Exhaust and Blowers

Northwest Engineering Co.
28 E. Jackson Blvd., Chicago, Ill.

Pettibone Mulliken Corp.
4710 West Division St., Chicago, Ill.

Pioneer Engineering Works, Inc. formerly
Pioneer Gravel Equipment Mfg. Co.
1515 Central Ave., N. E., Minneapolis, Minn.
Jaw Crushers, Roll Crushers, Horizontal Gradation Screens, Inclined Vibrating Screens, Revolving Screens, Belt Conveyors, Belt Conveyor Units, Quarry and Rock Plants

Pit and Quarry Publications
538 South Clark St., Chicago, Ill.
Pit and Quarry, Pit and Quarry Handbook, Pit and Quarry Directory

Robins Conveying Belt Co.
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Simplicity Engineering Co.
Durand, Mich.
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Smith Engineering Works
E. Capitol Drive at N. Holton Ave.,
Milwaukee, Wis.
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High Bridge, N. J.
Manganese and other Special Alloy Steel Castings

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The Traylor Engineering & Mfg. Co.
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Troco Lubricating Co., Inc.
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Warren Brothers Roads Co.
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National Crushed Stone Association

NETHERLAND PLAZA HOTEL, CINCINNATI, OHIO

January 30, 31, February 1, 1939

In conjunction with which will be held

THE MANUFACTURERS' DIVISION EXPOSITION OF MACHINERY, EQUIPMENT, AND SUPPLIES

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> "No man can gain the proper perspective of his own business unless he is a member and enters wholeheartedly into the activities of his trade body. Only the broadening influence of constant association with his competitors will keep him out of the rut that slowly but surely engulfs the man who stays too close to his individual job."

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